MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2022/2023 (TERM ID 2230)

DOS5311 – OPERATING SYSTEMS

(DIT)

5 OCTOBER 2023
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **4** pages with **2** sections.
2. Answer ALL questions.
3. Write your answers in the answer booklet provided.

Section A: Fill in the blanks (Total: 10 Marks)

Instruction: *Answer **ALL** the questions in the Answer Booklet provided.*

Thread	Thrashing	Mutual exclusion	Non-preemptive	Reusable
Program block	Consumable	Avoidance	Memory Swapping	Process control block
Least-Recently-Used	Preemptive	Process	Page Fault	Unequal-size
Fixed-size	Prevention	Logical organization	Physical organization	Optimal

1. Upon the creation of a new process, a(n) _____ will be created by the operating system in order to manage the process.

2. A(n) _____ is the smallest unit of execution within a process and shares the same memory and resources with others in the same process

3. First-Come-First-Served (FCFS) Scheduling is the simplest scheduling policy and it is also a(n) _____ scheduler.

4. Examples of _____ resources include interrupts, signals, messages, and information in I/O buffers.

5. _____ allows only one process to use a resource at a time, and no process can access a resource allocated to another process.

6. Deadlock _____ occurs when the system dynamically decides whether granting the current resource allocation request will potentially result in a deadlock.

7. In memory management system, _____ allows a user program's modules to be written and compiled independently.

8. _____ partition is a memory management scheme where the main memory is divided into variable-sized partitions to accommodate processes with different memory requirements.

9. The page replacement policy that is impossible to be implemented due to requiring the OS to have perfect knowledge of future events is called as _____ policy.

10. _____ happens when a computer's virtual memory subsystem experiences constant and high paging activity.

Continued.....

Structured Questions, 3 Questions (Total: 30 Marks)
Instruction: *Answer **ALL** the questions in the Answer Booklet provided.*

QUESTION 1 (10 Marks)

a. Illustrate two-state process model. List and explain the **TWO (2)** states in the model. (3 Marks)

b. Consider the following set of processes in **Table 1** with the length of the CPU-burst time given in milliseconds. The processes arrived according to the arrival time.

Process	Burst Time *(ms)*	Arrival Time *(ms)*	Priority
P_0	5	2	2
P_1	8	2	1
P_2	10	9	3
P_3	6	5	4
P_4	12	0	5

Table 1: Processes Arrival Time

Draw Gantt Charts illustrating the execution of these processes using the following scheduling algorithms.

i. First-Come-First-Served (1 Mark)

ii. Round-robin *(Quantum time:4)* (3 Marks)

c. Calculate the ***waiting time*** for each process and the ***average waiting time*** for **Round-robin** scheduling algorithm. (3 Marks)

QUESTION 2 (10 Marks)

a. Consider a system with **four** processes P_1, P_2, P_3 and P_4 and **three** resource types: A (5 instances), B (20 instances), C (9 instances).

	Resource A		Resource B		Resource C	
	Max	**Allocation**	**Max**	**Allocation**	**Max**	**Allocation**
P_1	2	0	5	5	3	1
P_2	5	1	15	2	0	0
P_3	2	2	1	1	6	1
P_4	4	2	7	2	2	2

Table 2: Resource Allocation

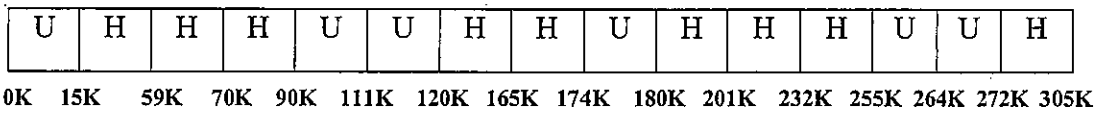
Continued.....

i. Based on the requirements and current allocations given in **Table 2**. Calculate the available resources. (0.6 Mark)

ii. Determine the content of the matrix *Need*. (2.4 Marks)

iii. Determine if the above system is in a safe state. (3 Marks)

b. Given a heap of memory management scheme with the following free list:



* U - Used
* H - Hole

The following process request will be received in order as listed in **Table 3**:

Process Number	Size in Kilobytes
P1	54
P2	52
P3	13
P4	27

Table 3: Process Request

Draw the memory allocation for each request above using the following memory allocation schemes:

i. Worst Fit (WF) (2 Marks)

ii. Best Fit (BF) (2 Marks)

QUESTION 3 (10 Marks)

a. Page replacement is crucial mechanism applied in virtual memory systems.

i. Explain the importance of the page replacement in memory management. (1 Mark)

ii. Explain how the page replacement algorithm operate in memory management. (2 Marks)

Continued.....

b. Consider the following page reference string as shown in **Figure 1**:

1,4,5,3,4,4,7,6,2,8,4,1,5,1,5

Figure 1: Page Reference String

Assuming a paging scheme with **FOUR (4)** empty frames, trace the allocation of pages to frames and identify the ***page faults*** using the following page replacement algorithms:

i. Least Recently Used (2 Marks)

ii. Optimal (2 Marks)

c. Name and briefly explain the file allocation method used in **Figure 2**. (3 Marks)

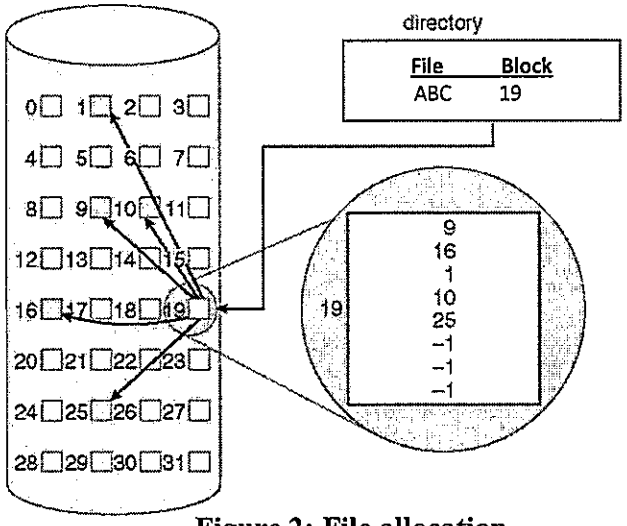


Figure 2: File allocation

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